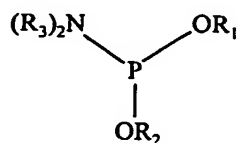


CLAIMS

We claim:

1. A compound of Formula I:



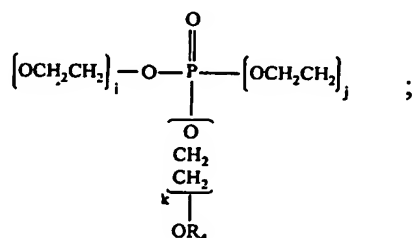
where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens, or $-\text{[A]}_n\text{-OR}_4$;

R_2 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens, or $-\text{[B]}_n\text{-OR}_4$;

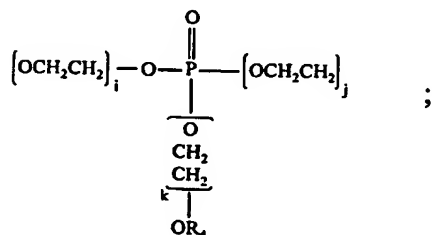
R_3 is $-\text{CH}_3$, $-\text{CH}_2\text{CH}_3$, or $-\text{CH}(\text{CH}_3)_2$;

R_4 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

A is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i\text{-O-P(=O)(O-)-[OCH}_2\text{CH}_2]_j$, or



B is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i\text{-O-P(=O)(O-)-[OCH}_2\text{CH}_2]_j$, or



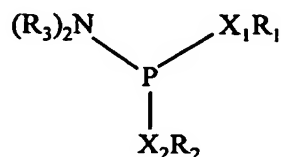
20

21

22 i, j, k, n are 1-20; and

23 where at least R_1 is $[A]_n-OR_4$ or R_2 is $[B]_n-OR_4$ or R_1 is $[A]_n-OR_4$ and R_2 is $[B]_n-OR_4$.

2. A compound of Formula II:



where X_1 is O, NH, or S;

X_2 is O, NH, or S;

Where at least X_1 is NH or S, or X_2 is NH or S;

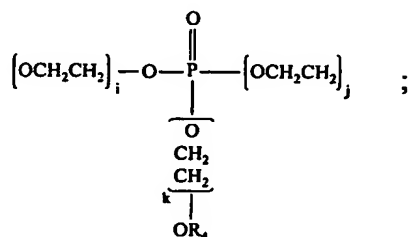
R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens, or $-\text{[A]}_n\text{-OR}_4$;

R_2 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens, or $-\text{[B]}_n\text{-OR}_4$;

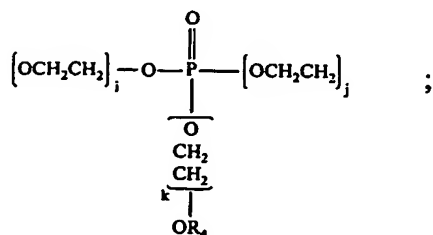
R_3 is $-\text{CH}_3$, $-\text{CH}_2\text{CH}_3$, or $-\text{CH}(\text{CH}_3)_2$;

R_4 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

A is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i\text{---O---P(=O)(O}^-\text{)---[OCH}_2\text{CH}_2]_j$, or



B is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i\text{---O---P(=O)(O}^-\text{)---[OCH}_2\text{CH}_2]_j$, or



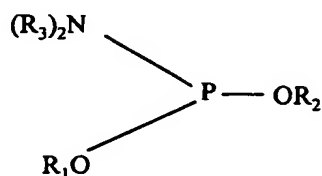
23

24

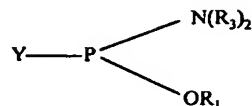
25 i, j, k, n are 1-20; and

26 where at least R_1 is $[A]_n-OR_4$ or R_2 is $-[B]_n-OR_4$ or R_1 is $[A]_n-OR_4$ and R_2 is $[B]_n-OR_4$.

3. A process for preparing a compound of Formula I:



comprising the step of reacting HO-R₂ with



wherein Y is a halogen;

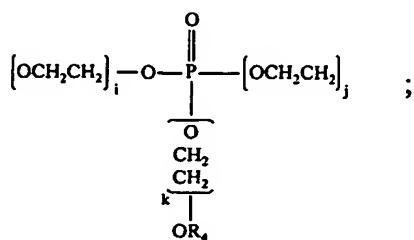
R₁ is -CH₂CH₂CN, -CH₂CH₃, -CH₃, -phenyl optionally substituted by one or more halogens, or -[A]_n-OR₄;

R₂ is -CH₂CH₂CN, -CH₂CH₃, -CH₃, -phenyl optionally substituted by one or more halogens, or -[B]_n-OR₄;

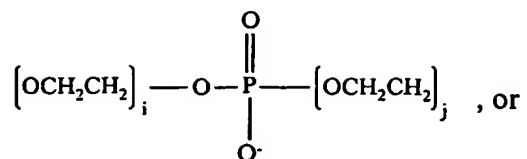
R₃ is -CH₃, -CH₂CH₃, or -CH(CH₃)₂;

R₄ is -CH₃, -alkyl, -phenyl, or -CONH₂;

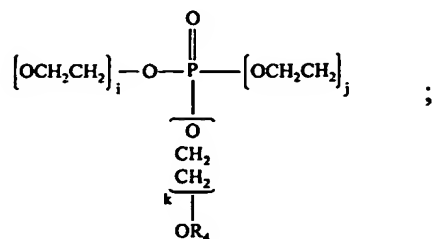
A is (CH₂CH₂O), (CH₂CH₂CH₂O), $[OCH_2CH_2]_i - O - P(=O)(O^-) - [OCH_2CH_2]_j$, or



23

24 B is (CH₂CH₂O), (CH₂CH₂CH₂O),

25



26

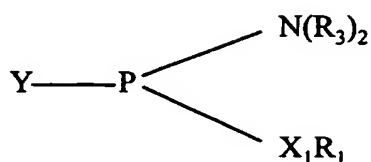
27

28

29 i, j, k, n are 1-20; and

30 where at least R₁ is [A]_n-OR₄ or R₂ is [B]_n-OR₄ or R₁ is [A]_n-OR₄ and R₂ is [B]_n-OR₄.

4. A process for preparing a compound of Formula II comprising the step of reacting R_2-X_2H with:



where X_2 is O, NH, or S;

X_1 is O, NH or S;

Y is a halogen;

R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens,

or $-\text{[A]}_n\text{-OR}_4$;

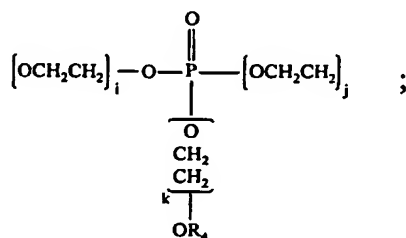
R_2 is $-\text{CH}_2\text{CH}_2\text{CN}$, $-\text{CH}_2\text{CH}_3$, $-\text{CH}_3$, -phenyl optionally substituted by one or more halogens,

or $-\text{[B]}_n\text{-OR}_4$;

R_3 is $-\text{CH}_3$, $-\text{CH}_2\text{CH}_3$, or $-\text{CH}(\text{CH}_3)_2$;

R_4 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

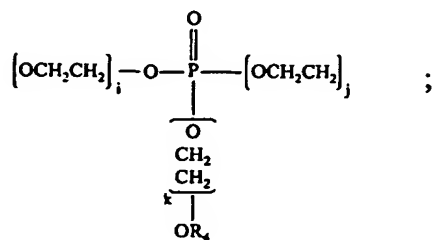
A is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i - \text{O} - \text{P}(\text{O})(\text{O}^-) - [\text{OCH}_2\text{CH}_2]_j$, or



20

21 B is $(\text{CH}_2\text{CH}_2\text{O})$, $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$, $[\text{OCH}_2\text{CH}_2]_i - \text{O} - \text{P}(\text{O})(\text{O}^-) - [\text{OCH}_2\text{CH}_2]_j$, or

22



23

24

25

26 i, j, k, n are 1-20; and

27 where at least R_1 is $[\text{A}]_n - \text{OR}_4$ or R_2 is $[\text{B}]_n - \text{OR}_4$ or R_1 is $[\text{A}]_n - \text{OR}_4$ and R_2 is $[\text{B}]_n - \text{OR}_4$.

- 1 5. An oligomeric compound linked to the compound of Formula I.
- 1 6. A chimeric oligonucleotide comprising a nucleoside linked to the compound
2 of Formula I.
- 1 7. A chimeric oligonucleotide comprising a nucleotide linked to the compound of
2 Formula I.
- 1 8. A chimeric oligonucleotide comprising an oligonucleotide linked to the
2 compound of Formula I.
- 1 9. A compound comprising a peptide linked to the compound of Formula I.
- 1 10. A compound comprising an amino acid linked to the compound of Formula I.
- 1 11. A compound comprising an oligosaccharide linked to the compound of
2 Formula I.
- 1 12. A compound comprising a sugar moiety linked to the compound of Formula I.
- 1 13. A growing oligomeric chain coupled to the compound of Formula I.

1 14. A method of using the compound of Formula I comprising the steps of
2 providing a nucleoside and covalently bonding the compound to the nucleoside to form a
3 chemically stable molecule.

1 15. A method of using the compound of Formula I comprising the steps of
2 providing an oligonucleotide and covalently bonding the compound to the oligonucleotide to
3 form a chemically stable molecule.

1 16. A method of terminating the elongation of failure sequences during synthesis
2 of an oligomer comprising the steps of:

- 3 a) providing a compound of Formula I; and
4 b) reacting the compound with the failure sequences.

1 17. A method of modifying the properties of a molecule comprising the steps of:

- 2 a) providing a compound of Formula I; and
3 b) reacting the compound with said molecule to modify the properties of
4 the molecule.

1 18. A method of modifying the surface properties of a support comprising the
2 steps of:

- 3 a) providing a compound of Formula I; and
4 b) reacting the compound with the support to modify the surface
5 properties of the support.

1 19. A method of preventing non-specific bonding of a molecule to reactive groups
2 on a support comprising reacting the compound of Formula I with the reactive groups on the
3 support.

1 20. A method of controlling the density of reactive groups on a support
2 comprising:

- 3 a) providing a pre-determined amount of the compound of Formula I; and
4 b) reacting the compound with the reactive groups to obtain a desired
5 density.

1 21. A method of oligonucleotide synthesis comprising contacting the growing
2 oligonucleotide chain with the compound of Formula I.

1 22. A method of synthesizing an oligonucleotide comprising the steps of :

2 a) attaching a first nucleoside to a support;

3 b) coupling a second nucleoside to the first nucleoside;

4 c) reacting any of the first nucleoside which remain uncoupled with a
5 compound of the Formula I; and

6 d) repeating steps b and c iteratively until the oligonucleotide is formed.

1 23. The method of claim 22 wherein the compound of Formula I links to a
2 reactive group selected from the group consisting of OH, NH₂ and carboxylate ester.

1 24. The method of claim 22 wherein the support is a solid support.

1 25. The method of claim 22 wherein the nucleoside is a phosphoramidite
2 nucleoside.

1 26. A method of synthesizing an oligonucleotide comprising the steps of:

2 a) providing a reagent comprising the compound of Formula I; and

3 b) using the reagent to covalently bond to reactive groups on the growing
4 oligonucleotide chain.

1 27. The method of claim 26 wherein the method of synthesizing the
2 oligonucleotide is solid-phase synthesis.

1 28. The method of claim 26 wherein the method of synthesizing the
2 oligonucleotide is solution-phase synthesis.

1 29. A product made by the method of claim 26.

1 30. A biological chip comprising the product of claim 29.

1 31. A microarray comprising the product of claim 29.

1 32. An assay comprising the product of claim 29.

1 33. An oligomeric compound linked to the compound of Formula II.

1 34. A chimeric oligonucleotide comprising a nucleoside linked to the compound
2 of Formula II.

1 35. A chimeric oligonucleotide comprising a nucleotide linked to the compound of
2 Formula II.

1 36. A chimeric oligonucleotide comprising an oligonucleotide linked to the
2 compound of Formula II.

1 37. A compound comprising a peptide linked to the compound of Formula II.

- 1 38. A compound comprising an amino acid linked to the compound of Formula II.
- 1 39. A compound comprising an oligosaccharide linked to the compound of
2 Formula II.
- 1 40. A compound comprising a sugar moiety linked to the compound of Formula
2 II.
- 1 41. A growing oligomeric chain coupled to the compound of Formula II.
- 1 42. A method of using the compound of Formula II comprising the steps of
2 providing a nucleoside and covalently bonding the compound to the nucleoside to form a
3 chemically stable molecule.
- 1 43. A method of using the compound of Formula II comprising the steps of
2 providing an oligonucleotide and covalently bonding the compound to the oligonucleotide to
3 form a chemically stable molecule.
- 1 44. A method of terminating the elongation of failure sequences during synthesis
2 of an oligomer comprising the steps of:
- 3 a) providing a compound of Formula II; and
- 4 b) reacting the compound with the failure sequences.

1 45. A method of modifying the properties of a molecule comprising the steps of:

2 a) providing a compound of Formula II; and

3 b) reacting the compound with said molecule to modify the properties of
4 the molecule.

1 46. A method of modifying the surface properties of a support comprising the
2 steps of:

3 a) providing a compound of Formula II; and

4 b) reacting the compound with the support to modify the surface
5 properties of the support.

1 47. A method of preventing non-specific bonding of a molecule to reactive groups
2 on a support comprising reacting the compound of Formula II with the reactive groups on the
3 support.

1 48. A method of controlling the density of reactive groups on a support
2 comprising:

3 a) providing a pre-determined amount of the compound of Formula II;

4 and

5 b) reacting the compound with the reactive groups to obtain a desired
6 density.

1 49. A method of oligonucleotide synthesis comprising contacting the growing
2 oligonucleotide chain with the compound of Formula II.

1 50. A method of synthesizing an oligonucleotide comprising the steps of :
2 a) attaching a first nucleoside to a support;
3 b) coupling a second nucleoside to the first nucleoside;
4 c) reacting any of the first nucleoside which remain uncoupled with a
5 compound of the Formula II; and
6 d) repeating steps b and c iteratively until the oligonucleotide is formed.

1 51. The method of claim 50 wherein the compound of Formula II links to a
2 reactive group selected from the group consisting of OH, NH₂ and carboxylate ester.

1 52. The method of claim 50 wherein the support is a solid support.

1 53. The method of claim 50 wherein the nucleoside is a phosphoramidite
2 nucleoside.

1 54. A method of synthesizing an oligonucleotide comprising the steps of:
2 a) providing a reagent comprising the compound of Formula II; and
3 b) using the reagent to covalently bond to reactive groups on the growing
4 oligonucleotide chain.

1 55. The method of claim 54 wherein the method of synthesizing the
2 oligonucleotide is solid-phase synthesis.

1 56. The method of claim 54 wherein the method of synthesizing the
2 oligonucleotide is solution-phase synthesis.

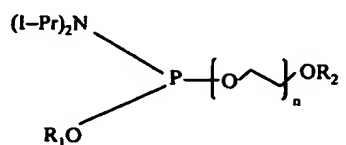
1 57. A product made by the method of claim 54.

1 58. A biological chip comprising the product of claim 57.

1 59. A microarray comprising the product of claim 57.

1 60. An assay comprising the product of claim 57.

61. A compound according to Claim 1 having the following formula:



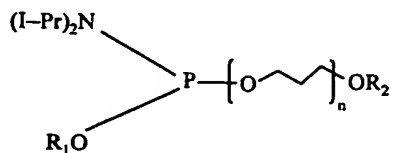
where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$ or $-\text{CH}_3$;

R_2 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

I-Pr is isopropyl; and

n is 1 to 20.

62. A compound according to Claim 1 having the following formula:



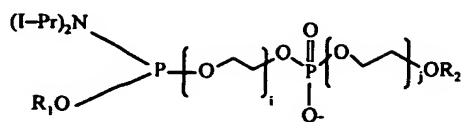
where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$ or $-\text{CH}_3$;

R_2 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

I-Pr is isopropyl; and

n is 1 to 20.

63. A compound according to Claim 1 having the following formula:



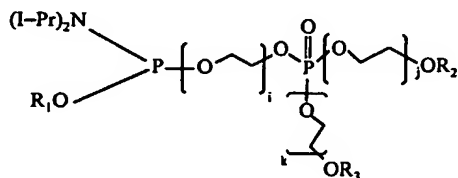
where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$ or $-\text{CH}_3$;

R_2 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

I-Pr is isopropyl; and

i and j are 1 to 20.

64. A compound according to Claim 1 having the following formula:



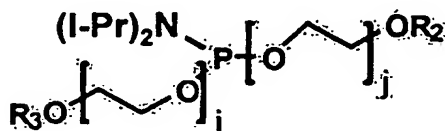
where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$ or $-\text{CH}_3$;

R_2 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

I-Pr is isopropyl; and

i , j , and k are 1 to 20.

65. A compound according to Claim 1 having the following formula:

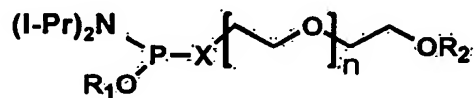


where R_2 and R_3 are $-\text{CH}_3$, -alkyl, or -phenyl;

I-Pr is isopropyl; and

i and j are 1 to 20.

66. A compound according to Claim 2 having the following formula:



where R_1 is $-\text{CH}_2\text{CH}_2\text{CN}$ or $-\text{CH}_3$;

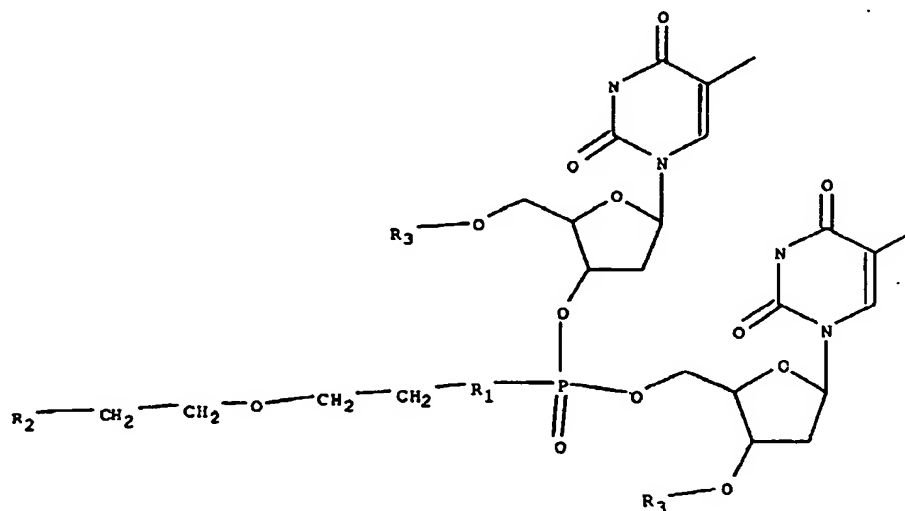
R_2 is $-\text{CH}_3$, -alkyl, -phenyl, or $-\text{CONH}_2$;

I-Pr is isopropyl;

n is 1 to 20; and

X is NH or S.

1 67. A chimeric oligonucleotide of the formula:



10 R₁ is O, S, or NH;

11 R₂ is OMe, OEt, Ak, Cy, Cb, Hy, or A;

12 R₃ is OH, Ak, Cy, Cb, or Hy;

13 A is any atom except H;

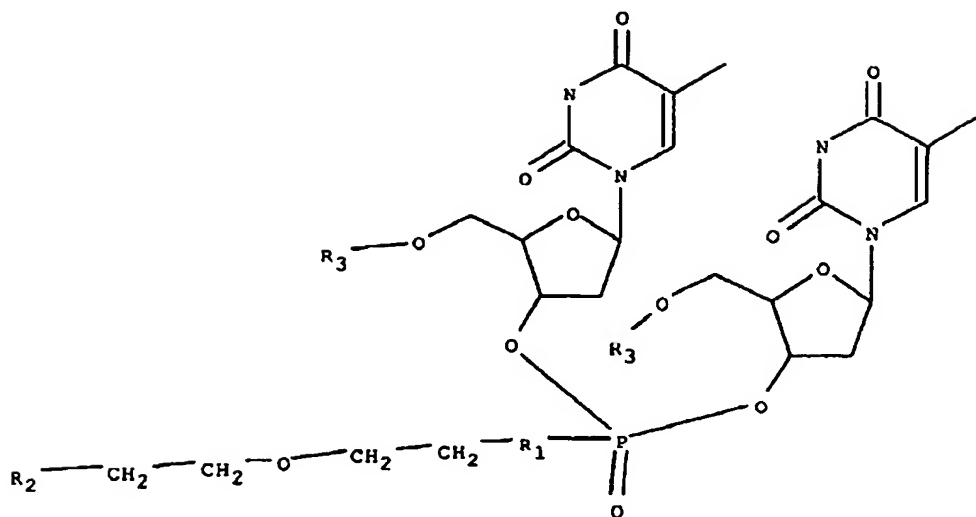
14 Ak is any alkyl chain;

15 Cy is any cyclic compound;

16 Cb is any carbocyclic compound; and

17 Hy is any heterocyclic compound.

68. A chimeric oligonucleotide of the formula:



R₁ is O, S, or NH;

R₂ is OMe, OEt, Ak, Cy, Cb, Hy, or A;

R₃ is OH, Ak, CY, Cb, or Hy;

A is any atom except H;

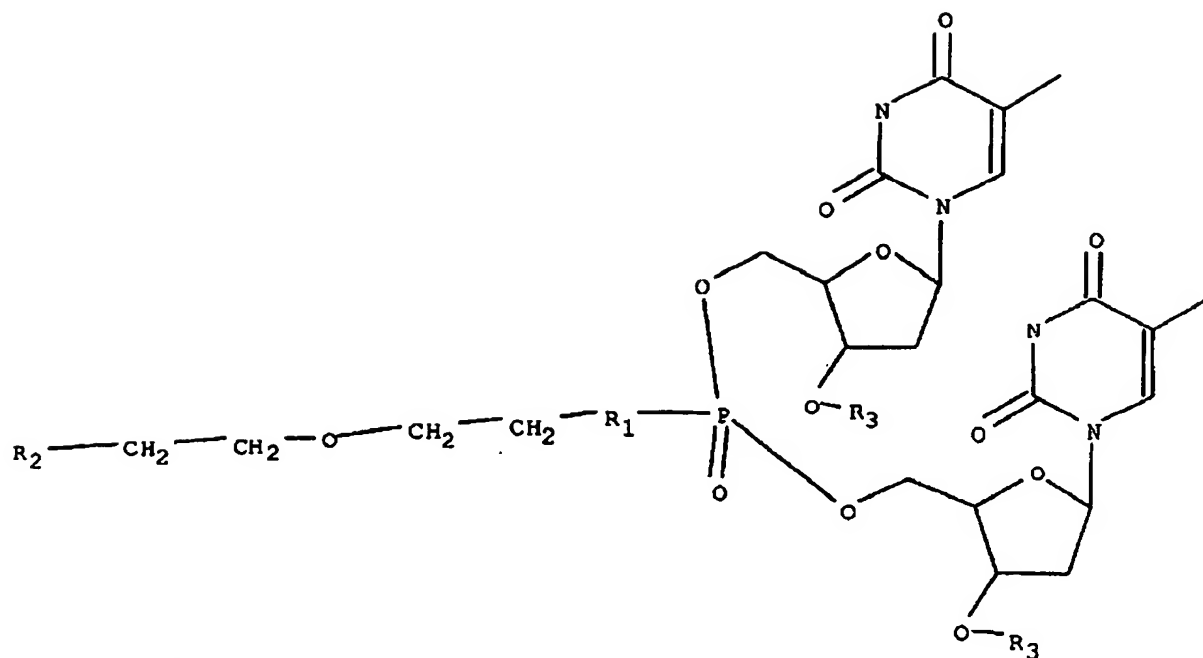
Ak is any alkyl chain;

Cy is any cyclic compound;

Cb is any carbocyclic compound; and

Hy is any heterocyclic compound.

- 1 69. A chimeric oligonucleotide of the formula:



- 2 R_1 is O, S, or NH;
 3 R_2 is OMe, OEt, Ak, Cy, Cb, Hy, or A;
 4 R_3 is OH, Ak, Cy, Cb, or Hy;
 5 A is any atom except H;
 6 Ak is any alkyl chain;
 7 Cy is any cyclic compound;
 8 Cb is any carbocyclic compound; and
 9 Hy is any heterocyclic compound.